

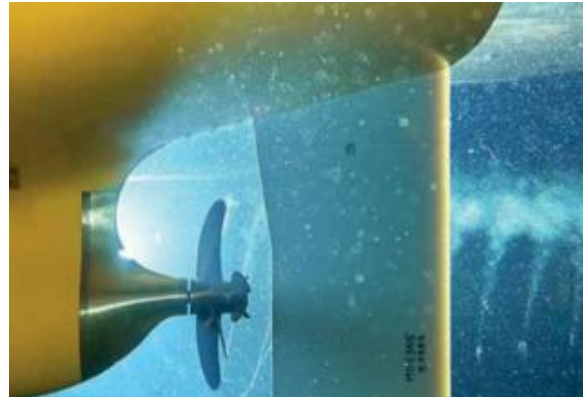
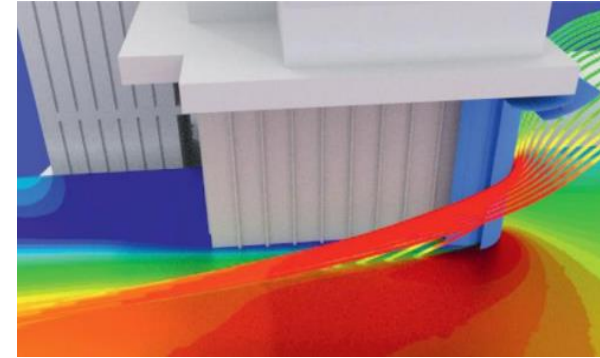
Boosting Ship Efficiency

Current available and future technologies for newbuildings and retrofits

S. Brüns, J. Lassen, J. Lemarechal, J. Strobel

Researching Ship Efficiency at HSVA

- 2011 „TARGETS“
- 2012 „GRIP“
- 2012 Air Cavity System
- 2013 „Form-Pro“
- 2014 „No-Welle“
- 2015 „Flipper“
- 2016 „In-Retro“
- 2017 „eSHaRk“
- 2017 Aeronaut
- 2018 AirCoat
- 2019 TrAM
- 2020 SAMSON, Twin-CRP
- 2021 GATERS
- 2022 News
- 2023 FlettnerFLEET
- To be continued ...



Boosting Efficiency - Current concepts

- Propeller Post-Swirl
 - Rudder bulb
 - Boss cap fin

1%

- Propeller Pre-Swirl
 - Stators, Ducts
 - Fins

3%

- Hull
 - Bulbous bow
 - Trim optimization
 - Hull vane
 - Air Lubrication
 - Coatings
 - ...

5%



Boosting Efficiency – Hot Candidates ?

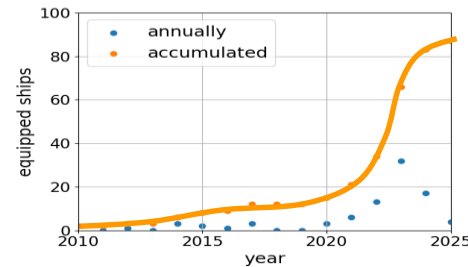
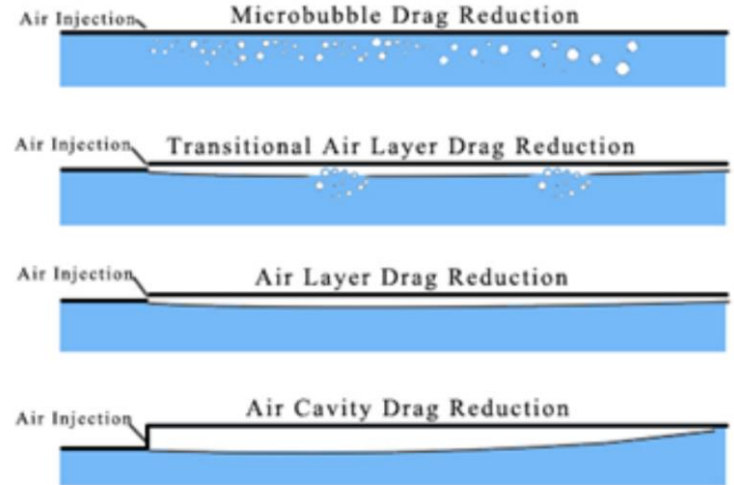
1. Air Lubrication - existing concept
2. Twin-CRP-POD for ULCS - new idea
3. Gate Rudder System - revolution ?

1. Air Lubrication

1. Air Lubrication – Fundamentals

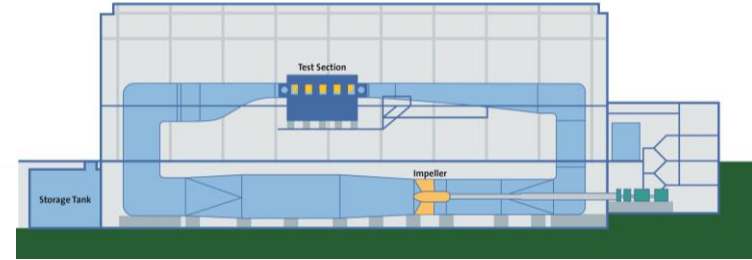
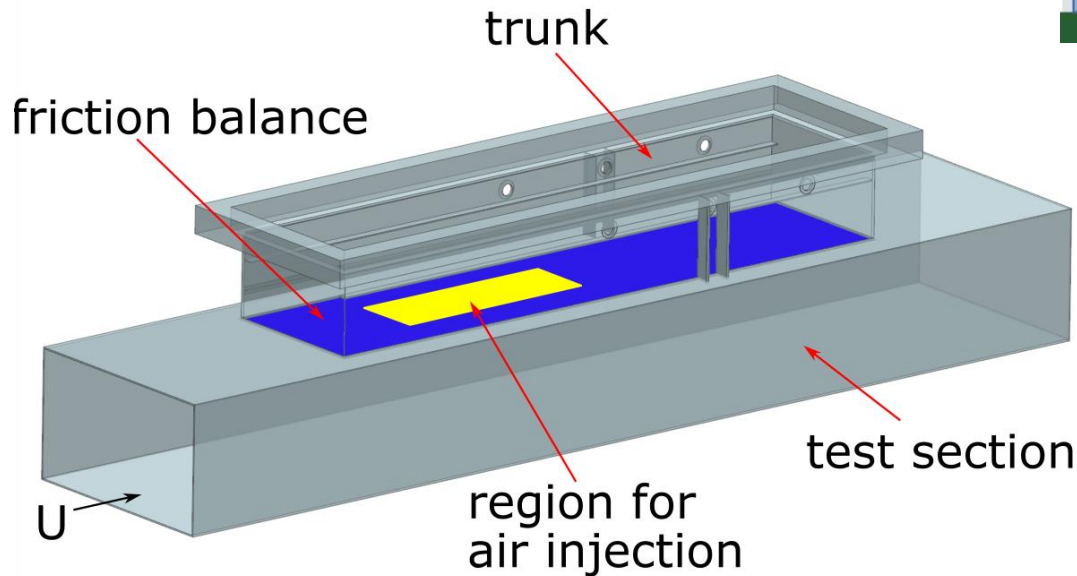
- Modification of the turbulent boundary layer
 - Air supply (bubble carpet/ air film)
 - Modification of the momentum transport
 - Changing the wetted surface

- Reduction of skin friction on the hull
- Potential energy savings
- Increasing amount of providers
- Fast growing number of installations

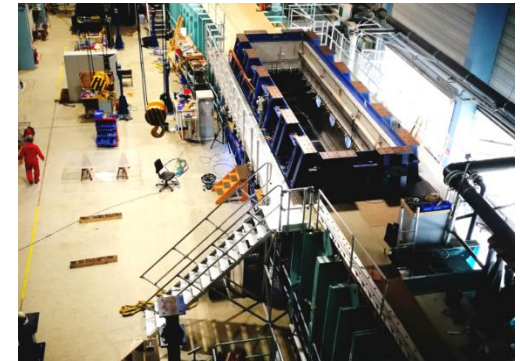


1. Air Lubrication – Test setup

- HYKAT

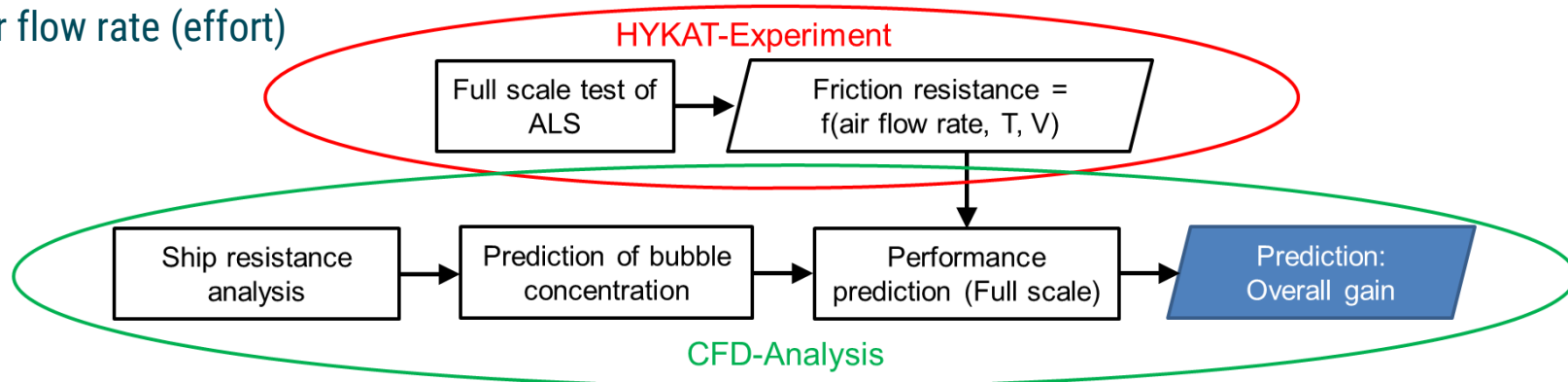


Test section:
2.80 x 1.60 x 11.00 m



1. Air Lubrication – Testing methodology

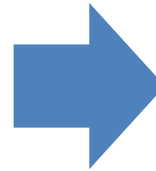
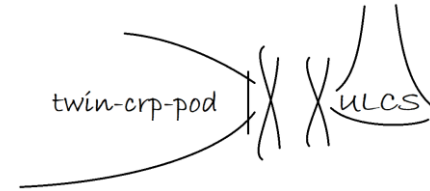
- Test of the Air Lubrication System at full scale
- Combination of experimental and numerical methods
- Measurement parameters
 - Characterization of generated bubbles
 - Frictional resistance (benefit)
 - Air flow rate (effort)



2. Twin-CRP-POD for ULCS

2. Twin-CRP-POD ULCS - Intro

- Ultra Large twin-screw Containership
- Optimize Propulsion Efficiency
- Single screw → twin screw

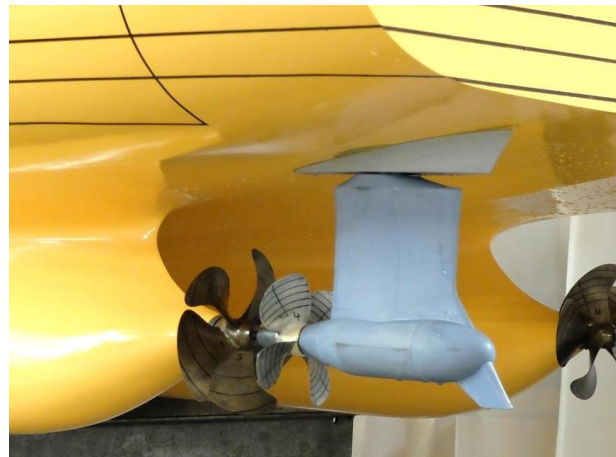


2. Twin-CRP-POD ULCS – Aft ship optimized



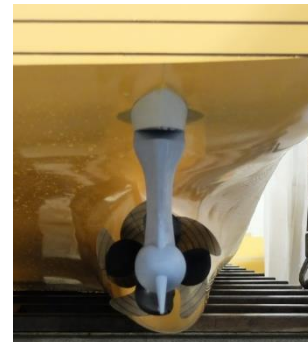
w/o hull change

A

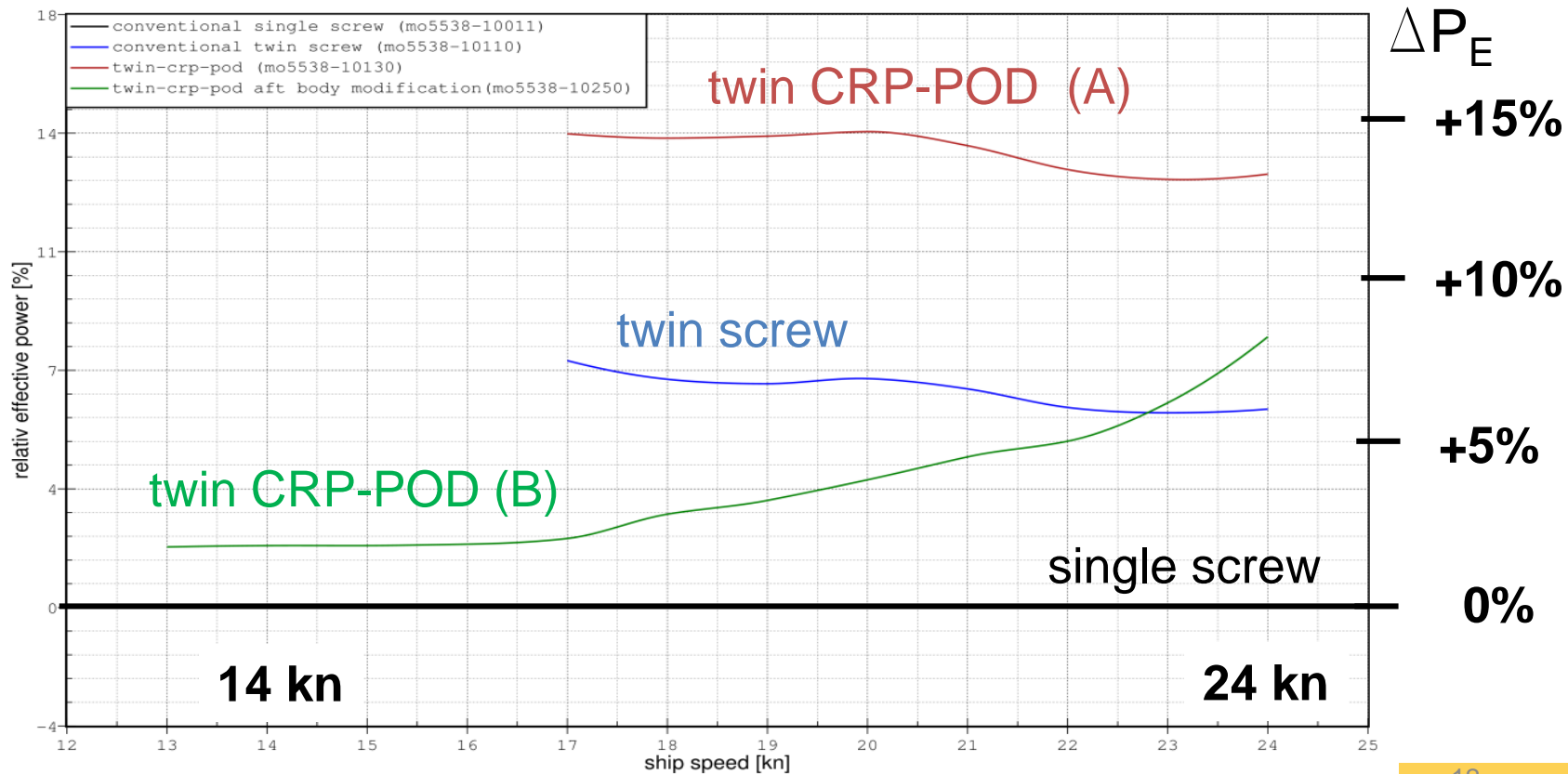


B

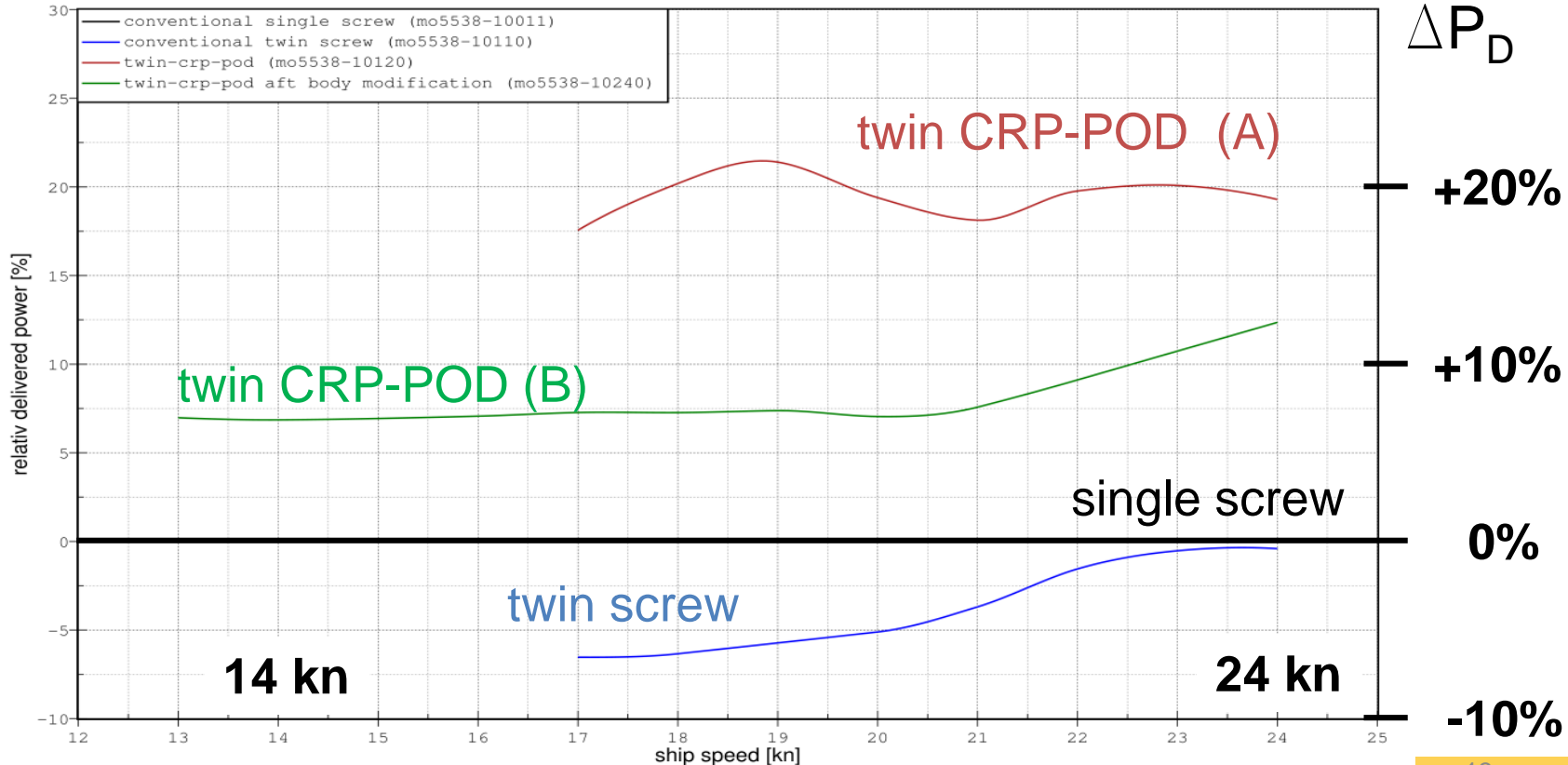
hull and head boxes optimized



2. Twin-CRP-POD ULCS – rel. Resistance

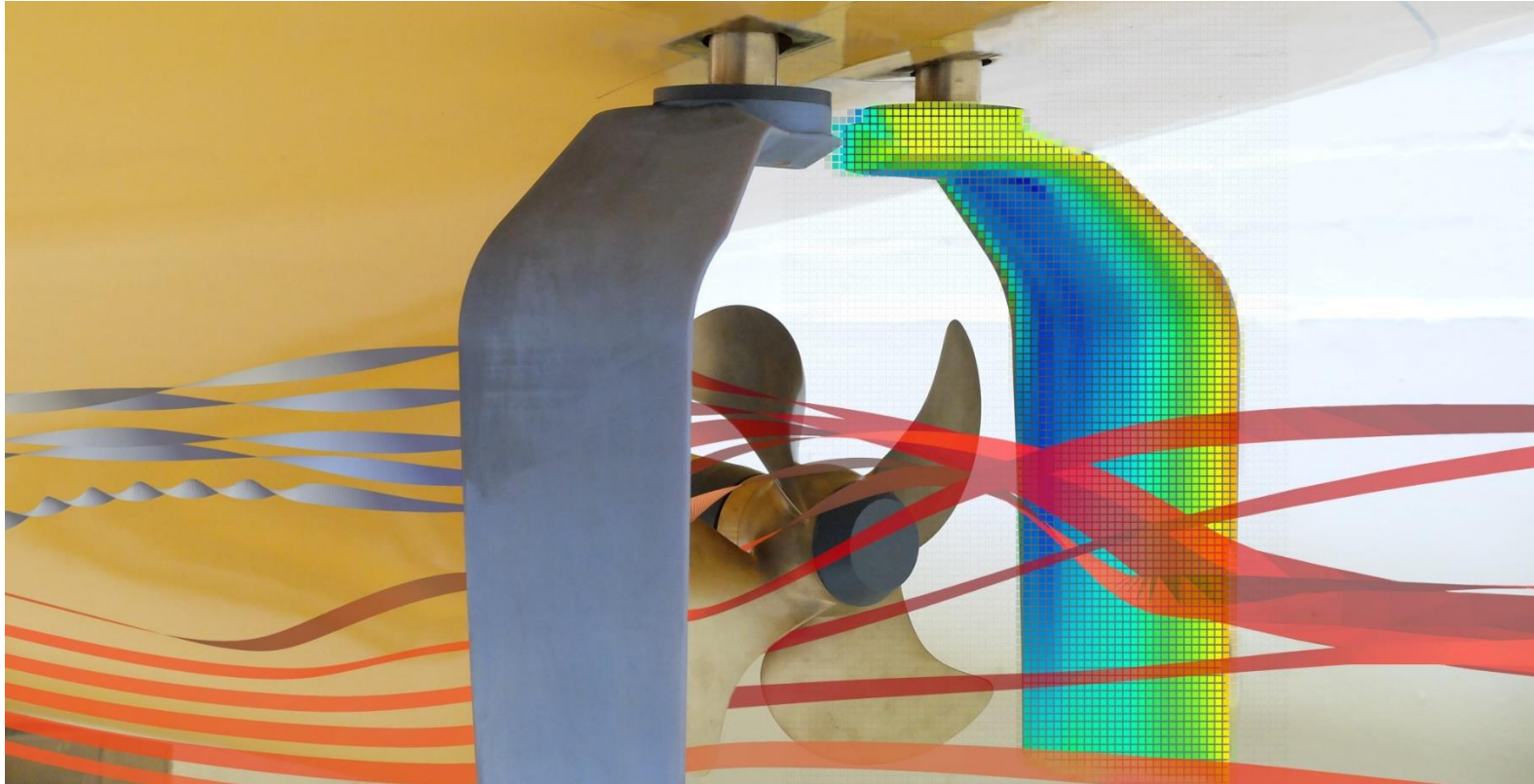


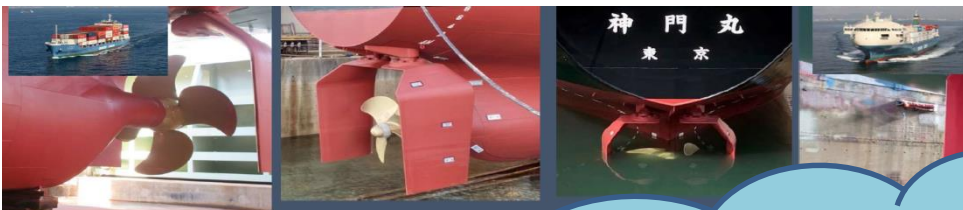
2. Twin-CRP-POD ULCS – rel. Power



3. Gate Rudder System

3. Gate Rudder System (GRS)





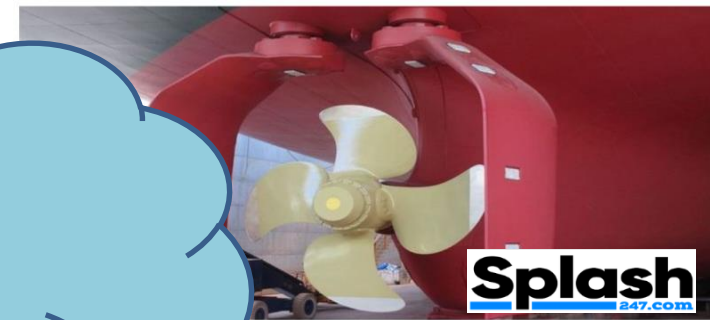
400 TEU Container Ship
"Shigenobu"

509 type General Cargo
"Koshin Maru"

Ship type	Container	General C
Built year	2017	2020
Sister ship	Sakura (2016)	ok
Hull Form	Existing	
Engine	Existing	
FOC save	22% (voyage data)	33%

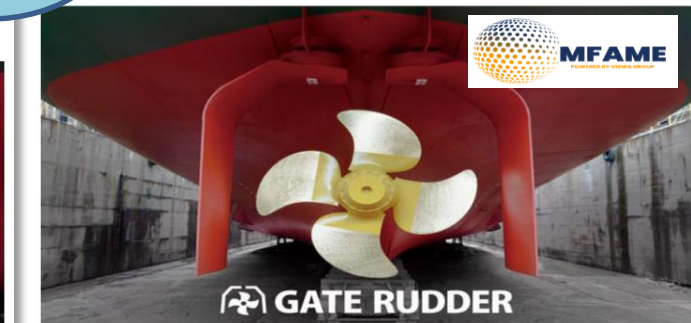
Scottish university develops new fuel-saving rudder system

Sam Chambers May 9, 2021 2,529 1 minute read



Rudder zeigt 15 %
Energieeinsparung

11. Mai 2021
facebook teilen Twittern Sie auf Twitter G+ p

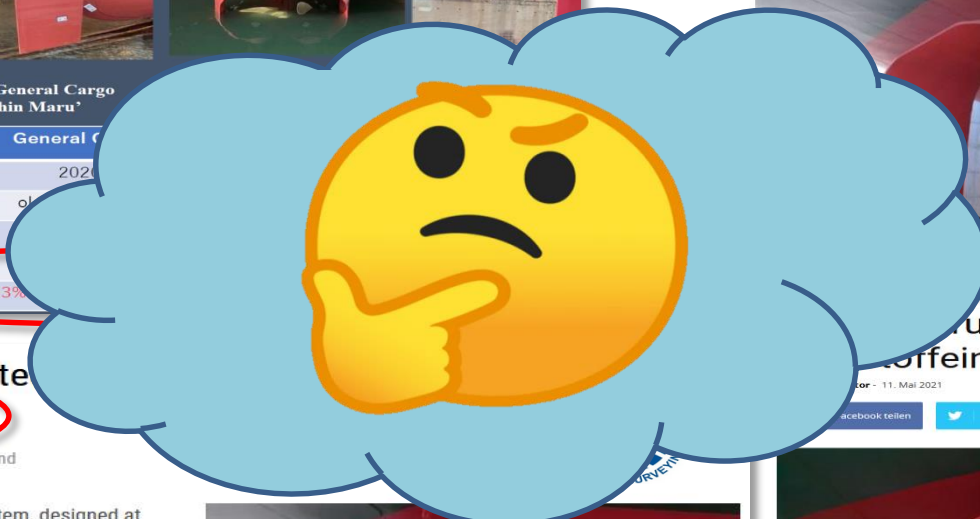
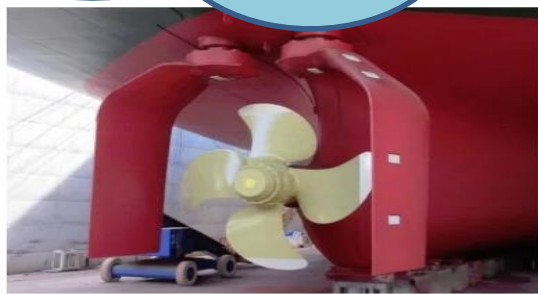


New gate rudder to save up to 30%

Posted on May 6, 2021 by News Hound

A more efficient gate rudder system, designed at the University of Strathclyde, will be demonstrated as part of a €6 million EU-funded research project. The GATERS project led by the University of Strathclyde under the Horizon 2020 Fund, will see the gate rudder – a novel propulsion and steering system – retro-fitted to a commercial vessel as part of a trial.

Unlike a traditional rudder which sits behind a ship's propellers to steer the vessel, the U-shaped gate rudder – essentially two separate rudders –





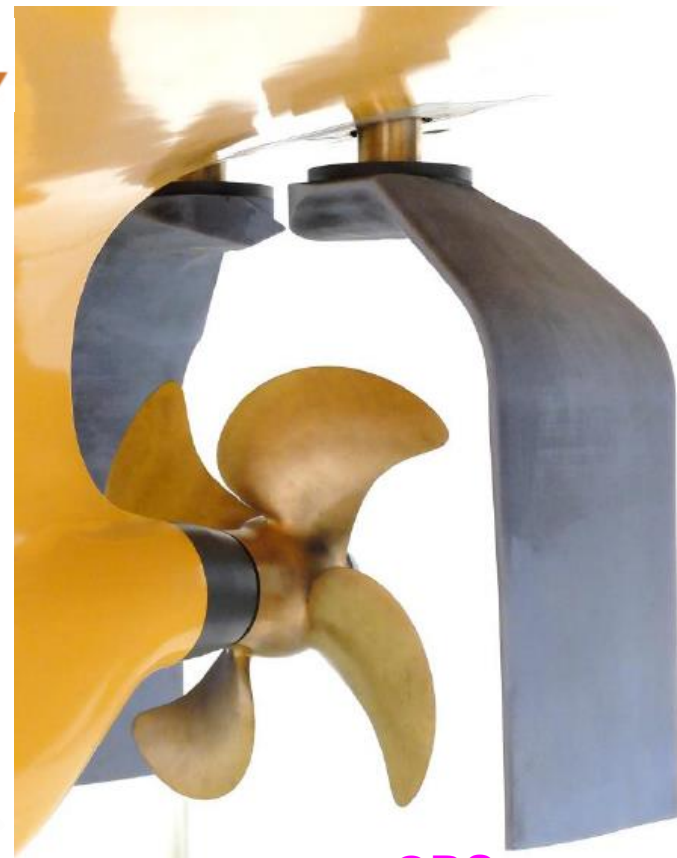
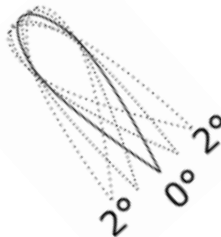
CRS



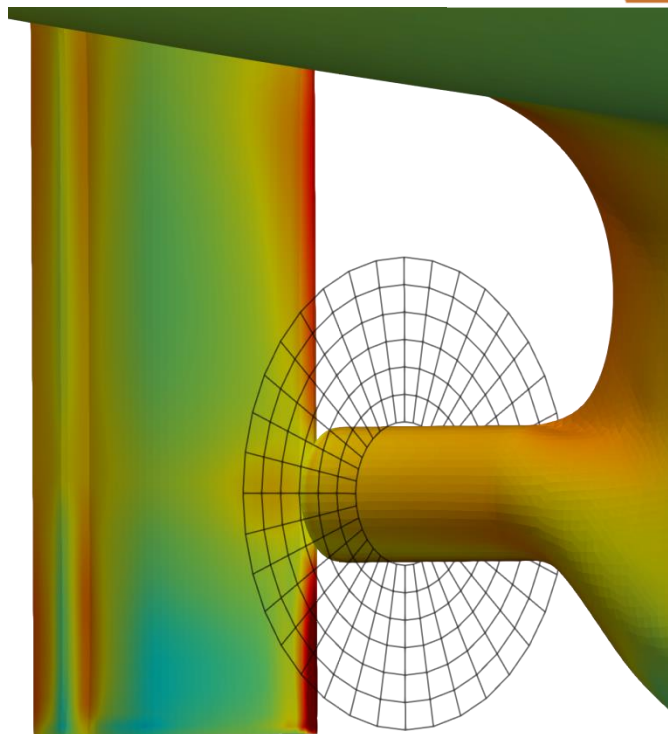
2 x



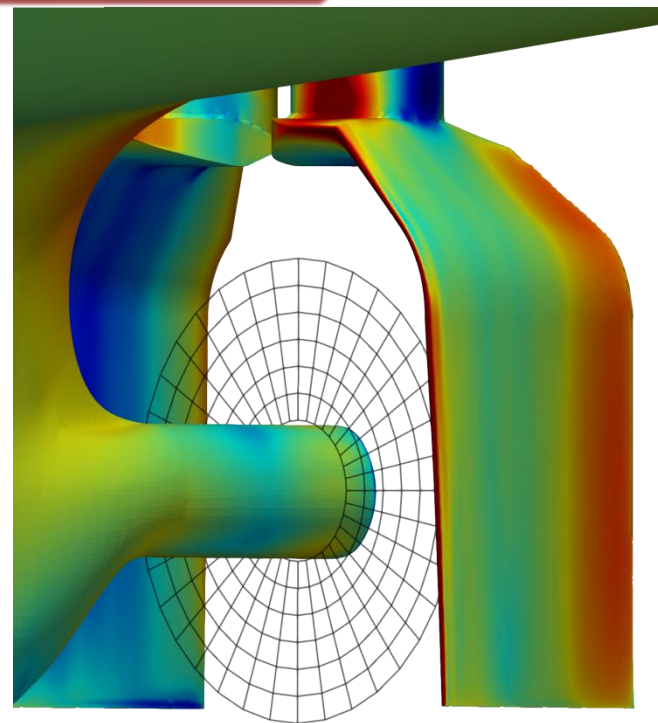
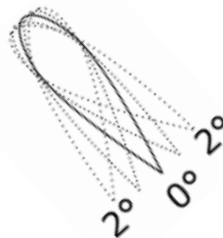
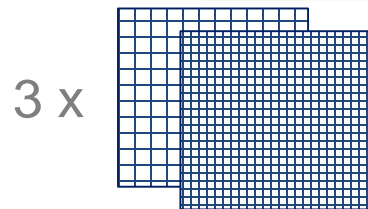
5 x



GRS



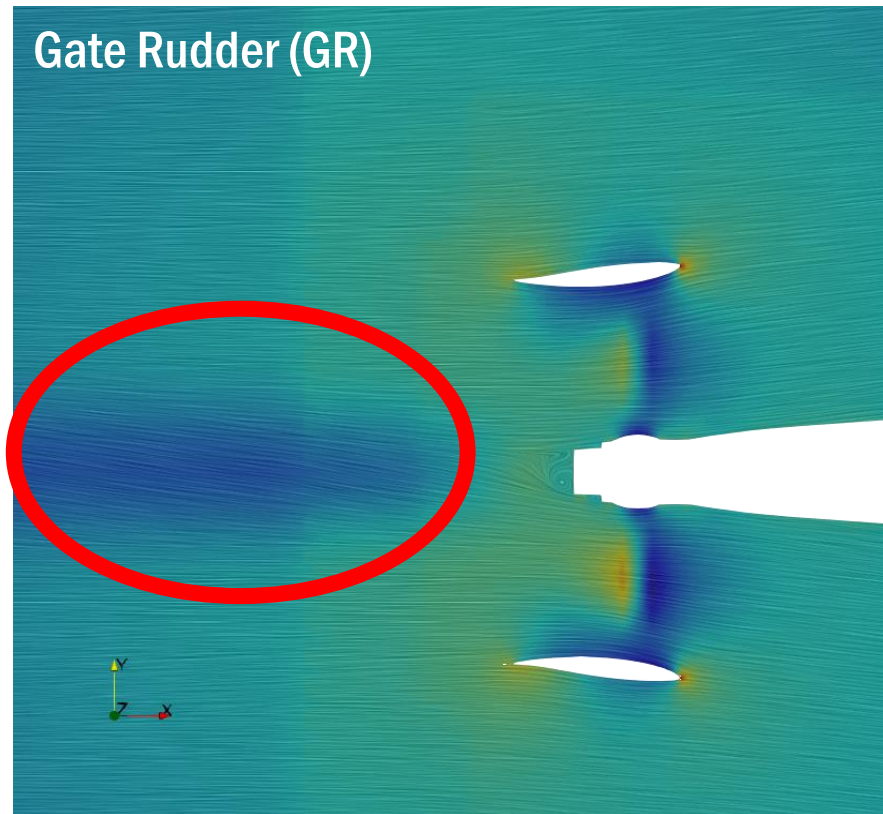
CRS



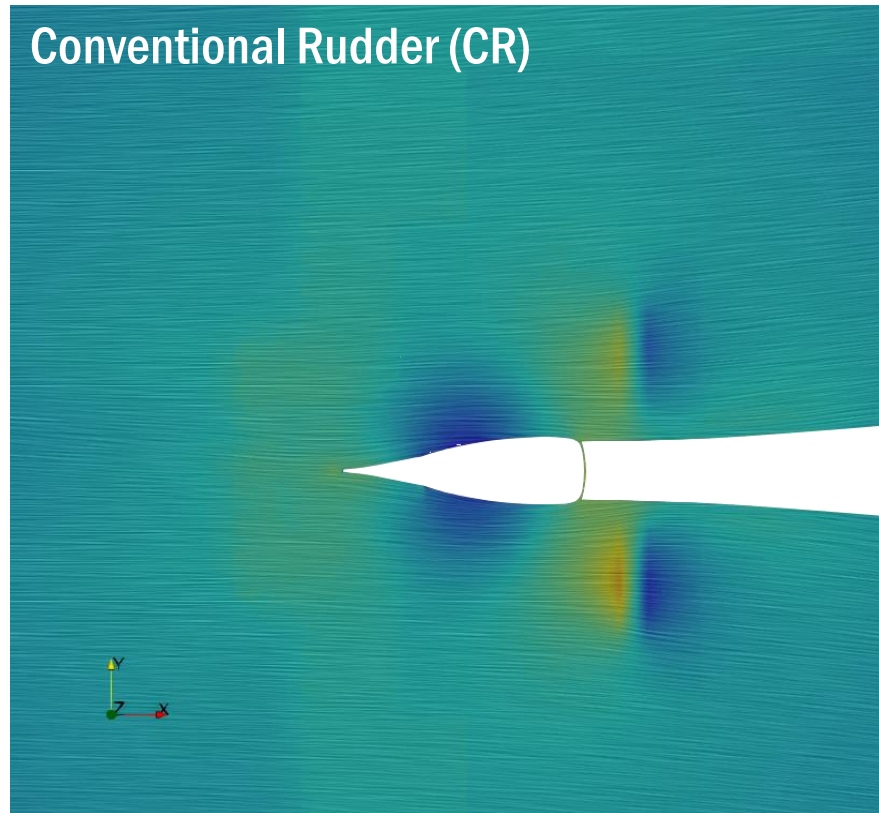
GRS

3. Gate Rudder – Flow details

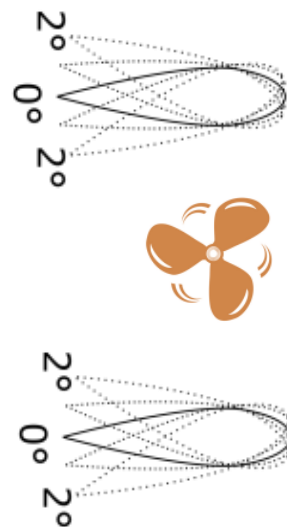
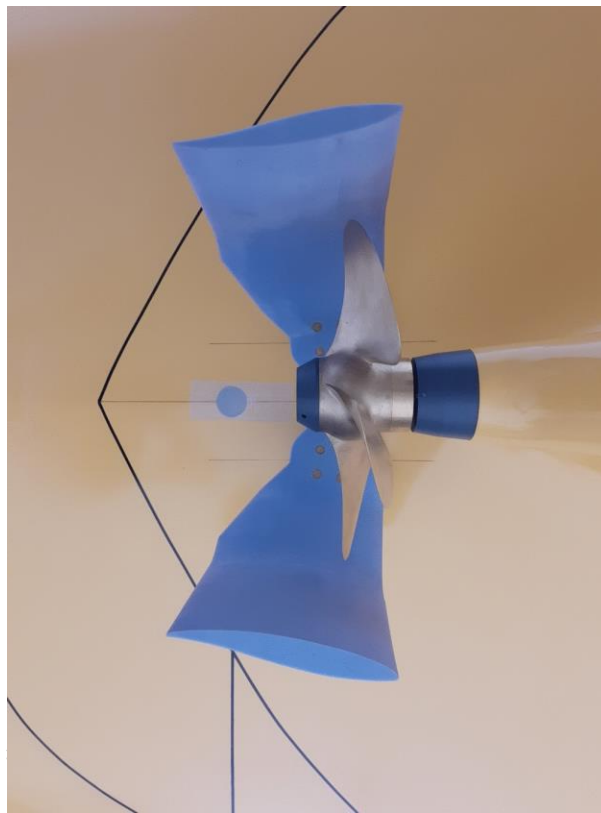
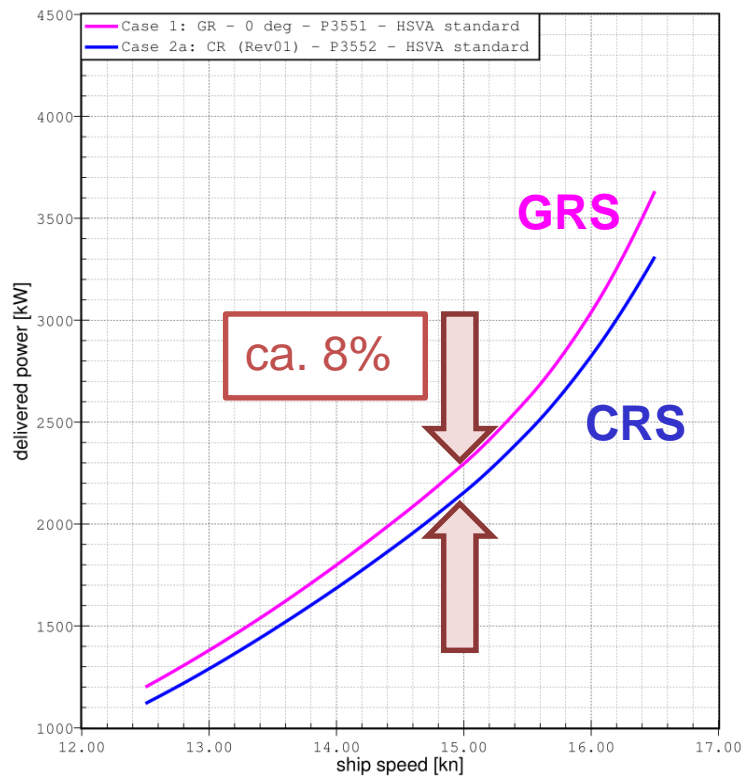
Gate Rudder (GR)



Conventional Rudder (CR)

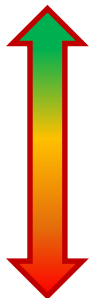


3. Gate Rudder – Power

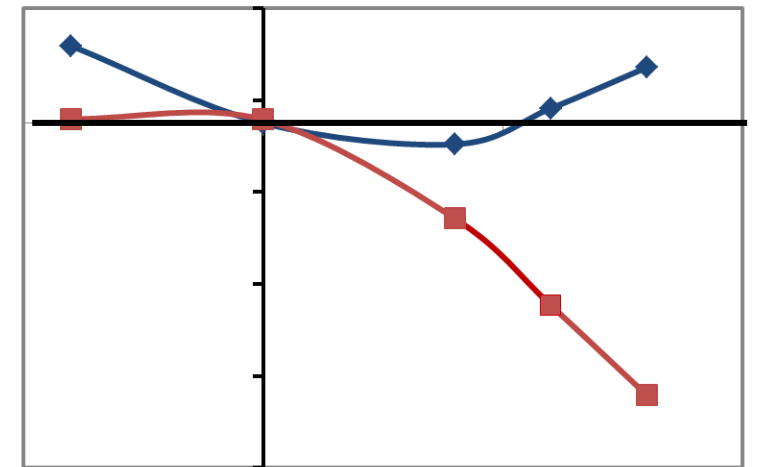




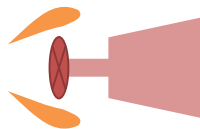
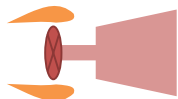
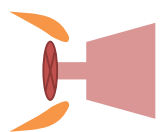
Thrust



Resist.



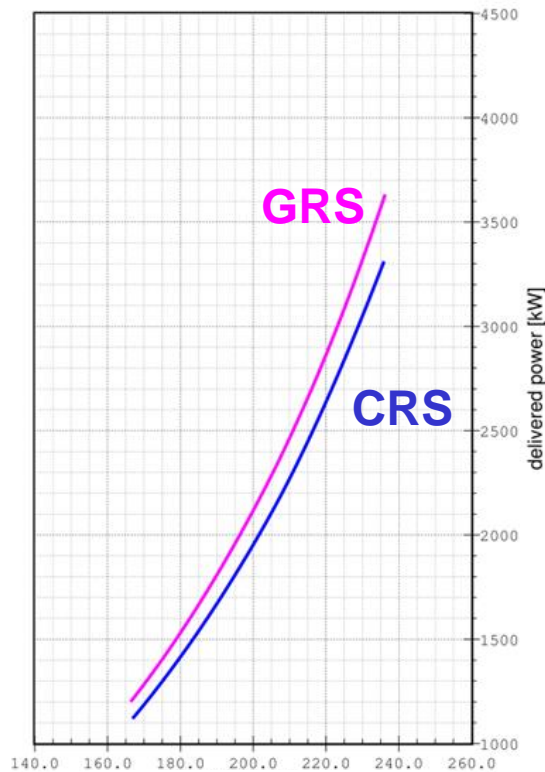
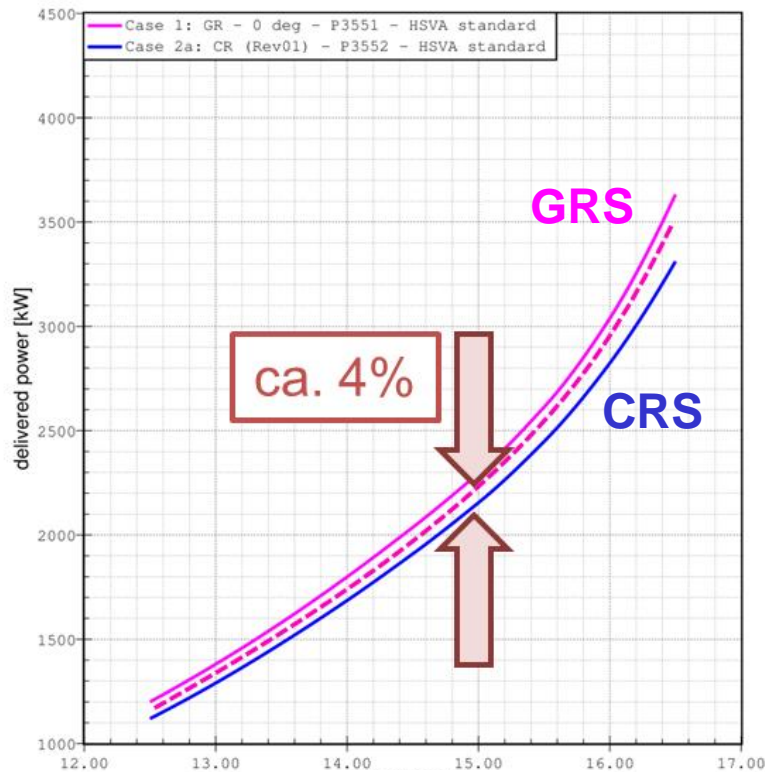
◆ Pd
■ Fx



Toe In

Toe Out

3. Gate Rudder – Power + Prop. Speed



Conclusion

- Multitude of concepts available
- Challenging to select
- Model Testing and CFD can assist
- Hot candidates require closer look
- Double Digit Savings are suspicious

Thank you.

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